

LETTERS TO THE EDITOR

Door-to-Balloon Time and ST-Segment Elevation Myocardial Infarction

I would like to congratulate the authors for their paper in the mini-focus issue on the ST-segment elevation myocardial infarction (STEMI) (1), for calling attention to the fact that door-to-balloon time might not be the best metric to assess successful treatment of STEMI (2). In their State-of-the-Art paper, the authors clearly point out that measuring door-to-balloon time ignores, for the most part, the pre-hospital phase of myocardial infarction. In the piece that I wrote for *Clinical Cardiology*, I made the point that door-to-balloon time is certainly a metric (i.e., easy to measure and can be documented accurately). Unfortunately, in the human it is nearly impossible to measure the precise onset of occlusion of a coronary artery. Many patients can present with stuttering chest pain for many hours before arriving in the emergency department, at which time that is the first indication of ST-segment elevation, and that is when door-to-balloon time is calculated.

There is no question that door-to-balloon time has been studied carefully and correlates well with successful outcomes. However, it does not take into account several factors that might influence the outcome positively or negatively. It seems to me that attention to details of the individual parameters noted before, during, and after percutaneous coronary intervention in STEMI patients might make a difference in outcome and should be considered when metrics of successful management of acute STEMI are being considered by oversight or regulatory bodies.

There are several clinical conditions that might influence outcome. For example:

Patients who have had a previous infarction might have a worse outcome than patients who present with a first infarction.

If chronic angina was present before STEMI, outcome might be better, because collaterals might be present.

If the patient was diabetic and not well-controlled, outcome might be poorer than a patient who is not diabetic.

If the patient was markedly hypertensive, outcome might be poorer than if the patient was normotensive or well-controlled with drugs.

If the patient had chronic obstructive pulmonary disease, outcome might be poorer than if the patient had normal lung function.

All these parameters, as far as I can tell, have not really been addressed in the classic articles on door-to-balloon time in patients presenting with STEMI.

Thus, I share the belief (and evidence) of the authors that mortality is strongly correlated with total ischemic time. However, I also would add other factors that might contribute to mortality

that are not really counted when the only metric measured is door-to-balloon time.

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doi:10.1016/j.jcin.2011.07.006

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2. Conti CR. Is door-to-balloon time the best metric to assess successful treatment of STEMI? *Clin Cardiol* 2011;34:408–9.

Reply

We appreciate the comments of Dr. Conti on our paper (1). We agree with Dr. Conti that the door-to-balloon (DTB) time is a well-established and well-studied measure in myocardial infarction. It is our opinion, however, that this measure fails to take into account the period before the patients present to the hospital. We also seem to have reached a plateau in terms of getting any further benefit by additional shortening of the DTB time. As reported by Flynn et al. (2), the DTB has declined in Michigan each year, from 113 minutes in 2003 to 76 min in 2008, but the mortality rate failed to follow this decrease. The in-hospital mortality was 4.1% in 2003 and 3.62% in 2008 ($p = 0.69$). Similarly, in 43,678 patients with acute myocardial infarction in the United States evaluated from 2005 to 2007, although the DTB time decreased from 101 to 87 min, the mortality did not change (3). Indeed, as stated in our paper, the true window for infarct salvage is ideally less than 2 h of ischemic time. Typically, the “door time” in much of the world is well beyond 2 h after start of symptoms, which explains why there is little-to-no correlation with improvements in DTB time and improvements in mortality.

Dr. Conti states that it is difficult to determine the onset of symptoms. We would suggest that although this is true of some patients, many patients are able to accurately report when their symptoms started. When DTB first began to be tracked, certain changes in data collection were made, such as arrival times and departure times, which then required efforts to synchronize clocks in emergency departments and catheterization laboratories, and so forth: efforts that are still incomplete. When and if we start tracking the true ischemic times, emergency responders and physicians will become more alert to the symptom onset as a valuable time to record. Thus, the estimation of the true ischemic time will become easier.

The factors suggested by Dr. Conti that influence the outcome of the patients with ST-segment myocardial infarction are all valid. Unfortunately, they are not adequately addressed in the trials where influence of DTB time on outcomes has been studied.

Our goal in treating myocardial infarction should be both to decrease mortality and preserve left ventricular function (prevent the development of heart failure). Because the time from symptom onset to reperfusion has been shown to decrease infarct size, it is only natural now to target it as representative of the total ischemic time. We should start measuring it routinely.

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doi:10.1016/j.jcin.2011.07.007

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Out-of-Hospital Cardiac Arrest Patients With ST-Segment Elevation on Electrocardiogram

Don't Rush Patients for Emergent Percutaneous Coronary Intervention in the Era of Aggressive Door-to-Balloon Time

As an institution that has a great interest in and has studied cardiac arrest and ST-segment elevation myocardial infarction (STEMI) (1), we read with great interest and agree with Dr. Kern (2) that we should provide "operators and medical centers the opportunity to do what is best for the individual STEMI patient, without fear of unfair inflation of their overall reported mortality figures."

We agree that "such a change cannot come too soon" for those cardiac arrest STEMI victims comatose on arrival to the hospital.

However, we now fear that with aggressive door-to-balloon-time initiatives and our prior report on STEMI and out of hospital cardiac arrest (OHCA), that operators are performing emergent percutaneous coronary intervention (PCI) too often in comatose patients when STEMI does not in fact truly exist.

A recent abstract from our institution by Abraham et al. (3), presented at the most recent American College of Cardiology Scientific Sessions, noted that aggressive catheterization was performed in patients with noncardiac causes of ST-segment elevation on electrocardiogram. Many of these patients had OHCA and the catheterization delayed the diagnosis and treatment of the primary etiology. Subsequent work-up showed that the cause of mortality was varied and included sepsis, hyperkalemia, intracranial hemorrhage, aortic dissection, left ventricular aneurysm, and pulmonary embolism.

We are now victims of our own success in that we had concluded in 2009 that "resuscitated patients with STEMI in the ED should be seriously considered for emergent revascularization regardless of neurologic status. These patients should be treated with the same urgency as patients with acute STEMI without cardiac arrest (1)."

We agree with Dr. Kern and advocate aggressive evaluation and treatment of comatose OHCA patients found to have diagnostic STEMI with emergent PCI and therapeutic hypothermia. However, we emphasize not to push every arrest patient to the catheterization laboratory without appropriate evaluation in the emergency department to ensure coronary obstruction as an etiology for the event. Not infrequently, these ST-segment changes are concurrent with another catastrophic event that leads to ischemic changes on the electrocardiogram.

Though, the mantra has always been "time is myocardium," a 5-min delay in door-to-balloon time to practice sound clinical medicine is unlikely to cause higher mortality and morbidity. However, delaying treatment of the true etiology of arrest by performing emergent catheterization may, in fact, do so.

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doi:10.1016/j.jcin.2011.07.004

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